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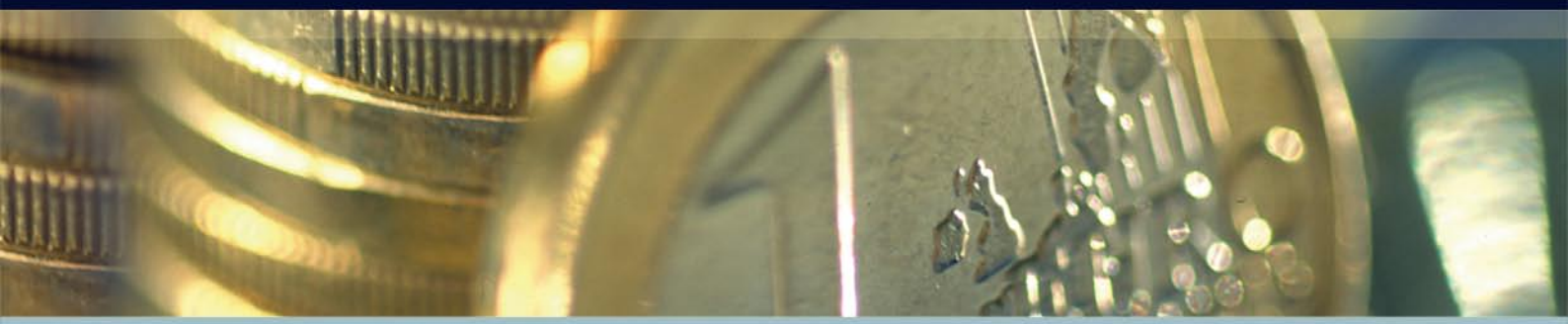

The quest for the best consumer confidence indicator

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The quest for the best consumer confidence indicator

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Abstract

Out of 11 questions included in the EU harmonised consumer questionnaire, it is possible to construct 2 047 different consumer confidence indicators. We search through all these indicators in order to find the single indicator that has the highest correlation with private consumption growth. Moreover, we contrast this indicator to the current Consumer Confidence Indicator used by the European Commission, and some alternative indicators; also in terms of their predictive power of private consumption. The focus of the analysis is thereby on how to best exploit the information content of the current set of questions included in the harmonised consumer questionnaire, while other methodological aspects of the construction of the indicator is left aside.

In this context, we test the hypothesis that an indicator based on questions related to the household, rather than the general economy, would prove informative. It seems reasonable to assume that respondents to the surveys have better knowledge of their own economic situation than they have of the general economic situation in their country. We find that this "micro" indicator, as well as an optimal indicator that takes into account the specifics of all EU member states, outperform the current Consumer Confidence Indicator. Both these indicators also perform better than an indicator based on the popular factor methodology.

Key Words: Consumer confidence, private consumption, and predictive power

JEL Classification: E21, E27, and E29

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1. Introduction

In co-operation with national partner institutes, the European Commission through the Directorate-General for Economic and financial Affairs (DG ECFIN), surveys more than 40 000 consumers across the EU each month. The results from those surveys reflect consumers' opinions about the past, current, and future economic developments, and complement quantitative statistics that are often available after significant delay. The survey data provide useful information of the current state of the economy and forecast short-term developments and hence are closely followed by economists, policy–makers, and business managers. It is thus essential that the published indicators give correct and reliable signals.

Consumer sentiment is summarised by the Commission in the Consumer Confidence Indicator (CCI), which is a composite indicator based on answers from several questions in the questionnaire. The CCI is generally viewed as a timely pointer of developments in private consumption. However, for both the EU and the euro-area aggregate, the correspondence between actual consumption growth and the CCI is somewhat weak. Therefore, the aim of this paper is to search for the best possible survey-based indicator for tracking private consumption growth at the EU and euro-area level.

The questionnaire facing consumers is composed of both macro-oriented questions (e.g. the general economic situation in the country and unemployment) and micro-oriented questions (e.g. the financial situation of the household and the intention of the respondent to spending on capital goods). The CCI is based on two questions from each of these two categories, and we will show that this set of questions is not using the information available efficiently in order to track consumption growth.

Out of 11 questions included in the questionnaire, it is possible to construct 2 047 $\left(2^n - 1\right)$ different combinations of the questions, i.e. indicators.[1] We search for the single indicator that has the highest correlation with private consumption growth. Moreover, we contrast this indicator to the CCI, and some alternative indicators, also in terms of their predictive power of private consumption. The focus of the analysis is thereby on how to best exploit the information content of the current set of questions included in the harmonised consumer questionnaire, while other methodological aspects of the construction of the indicator is left aside for future research.

Against this approach, we also test a specific hypothesis, i.e. that an indicator based on questions related to the household, rather than the general economy, would prove more informative. There are at least two a priori rationales for including micro-oriented questions rather than macro-oriented questions. First, it seems reasonable to assume that respondents to the surveys have better

[1] The consumer questionnaire includes 12 questions, but we exclude question 12 due to lack of harmonisation across countries.

knowledge of their own economic situation than they have of the general economic situation in their country. Given shortage of both time and ability, it simply makes more sense for the individual consumer to give priority to seeking information on their own economic situation rather than on the general economy. It is presumably also easier to gather information on and predict the household's own economic situation.

Second, if the aim is to predict developments in household consumption, micro questions seem preferable also on a conceptual basis. As long as survey samples are representative, the questions on household's financial situation, its intention to spend or to save (variables that may reflect the household's budget constraints) should aggregate into an indicator that resembles consumption. An indicator that includes questions on the general economic situation of the country should, on the other hand, aggregate into something that is different from consumption (possibly GDP).

The remainder of this paper is organised as follows. The following section presents an overview of the theoretical and empirical literature on consumption and the role sentiment has in explaining consumption growth. Section 3 introduces the consumer confidence indicator used by the European Commission. Here we also propose an alternative indicator and present a background to the topic. Section 4 defines the ideal indicators and compares their performance to the performance of other indicators. In Section 5 we study the predictive power of the indicators, and Section 6 summarises and concludes.

2. Theoretical and empirical work

2.1 Economic Theory and Consumer Sentiment

The role of consumer sentiment in theories of consumption behaviour is not obvious. The classical theory for explaining household's consumption behaviour is the life-cycle permanent income hypothesis (LC-PIH).[2] The LC-PIH predicts that consumption depends on permanent income, which is the annuity of overall life time resources. The theory implies that consumption is unrelated to current income, and if expectations are rational, consumption will follow a random walk.[3] Thus, there will be no role for consumer confidence in predicting actual consumption.

Numerous empirical studies, however, find that consumption indeed is related to current income, which consequently leads to a rejection of the life-cycle permanent income hypothesis in its purest form. To explain this deviation from the LC-PIH, some modification of its original form has been put forward. According to the model of Campbell and Mankiw (1989) some households are strict life-

2 Friedman (1957)

3 Hall (1978)

cyclers, while others follow a "rule of thumb" and let their spending equal to current income. This model only leaves room for consumer sentiment to predict spending through the income channel.

Another line of reasoning concerns uncertainty. This, so called, uncertainty hypothesis states that the more income uncertainty consumers are facing, the more prone to be myopic they are, and hence they are less likely to show a life-cycle behaviour. Instead they are more prone to act myopic. A large drop in current income would increase uncertainty and the need for precautionary savings, thereby lowering consumption. Thus, this hypothesis can explain a positive link between current income and consumption, a linkage which should be increasing with uncertainty (Blanchard and Fischer, 1989). By reflecting uncertainty, consumer sentiment may therefore also be useful for predicting spending.

Overall, these theories leave very little room for sentiment to play a role in determining consumption. Some have even argued that consumer sentiment simply reflects other economic determinants of private consumption. According to this view, once the appropriate underlying economic determinants have been identified and properly measured, there is no additional information value in consumer sentiment.

However, in his seminal work, Katona (1968) question this view and claim that private consumption is determined by both the consumer's ability (disposable income, wealth) and willingness to pay. The latter, he argues, derives from complex psychological factors and cannot in a convenient way be explained by a simple hard measure, such as income. Movements in consumer sentiment would capture changes in the willingness to pay. Thus, according to this line of reasoning, consumer sentiment is not just a reflection of hard data, but captures something unique - of incremental importance - to private consumption. This is also along the line of reasoning by Blanchard (1993), who argues that the spontaneous fall in US household consumption in the early 1990's was caused by households "animal spirits".

2.2 The Predictive Power of Consumer Sentiment – what does the empirical literature say?

The empirical research using consumer surveys for predicting developments in private consumption has mainly been based on consumer surveys done in the US. There are two closely watched US consumer surveys: the University of Michigan's Index of Consumer Sentiment (ICS) and

the Conference Board Index (CBI).[4] Bram and Ludvigson (1998) find that the CBI provides incremental predictive value for private consumption. Eppright et al. (1998) conclude that consumer expectations have superior predictive power, in comparison to other economic indicators. Carroll et al. (1994) take a two-step approach. First, they ask whether consumer sentiment has predictive power for future consumption spending; second, whether this power persists also after controlling for other available indicators. They conclude that there is at least some incremental predictive power of the consumer sentiment. In contrast to many other studies, Howrey (2001) recognises that for real-time forecasters an important advantage of consumer confidence data is that it is provided monthly with a very short publication delay. This means that even a contemporaneous value of confidence may be used as a predictive variable. In his study, Howrey finds that including consumer sentiment (ICS) has a statistically significant effect when forecasting quarterly private consumption, although its incremental value is fairly modest.[5] However, when taking into account private consumption and disposable income for the first month of the quarter, this small value added vanishes.

While most US studies seem to confirm the predictive power of consumer sentiment there are exceptions. Ludvigson (2004) finds that, once controlling for other explanatory variables, both the ICS and the CBI have only a modest incremental predictive power for consumer spending. Moreover, by using a real-time data set, Croushore (2006) finds that consumer confidence does not improve forecasts of private consumption once controlling for lagged private consumption and stock prices. Also, Madsen and McAleer (2000) find consumer confidence unable to predict consumption.

For the UK, Easaw et al. (2005) find that consumer confidence predicts household's consumption of durable goods. The predictive power of confidence is not only due to its capacity to predict labour income, and thereby indirectly also spending, but confidence also seems to have a direct link to spending. However, confidence ability to predict spending on non-durable goods seems to pass only via the income channel.

In sum, even though the above studies in general suggest that consumer confidence has predictive power in explaining developments in consumer spending, it is of course impossible to rule out that it is not just a reflection of omitted variables, yet to be discovered. The studies above do, however, include control variables by guidance from economic theory (labour income, interest rate, wealth etc.) Furthermore, since the construction of consumer confidence indicators varies across

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[4] The ICS is based on the responses to five questions: (1) household's current finances, (2) current buying conditions, (3) finances in the year ahead, (4) general business conditions in the year ahead, and (5) general business conditions over the next five years. The CBI consists of the following five questions: (1) current business conditions, (2) current employment conditions, (3) business conditions, (4) employment conditions, and (5) total family income for the next six months. Besides the different questions in the two surveys, both the calculation of the indexes and survey methods differ as well.

[5] Additionally, Howrey (2001) finds that the ICS, either by itself or in conjunction with other indicators, predicts future growth rates of GDP.

countries, the findings for the US and the UK cannot necessarily be generalised to hold also for other countries. Moreover, the mechanism behind sentiment and actual consumption growth may differ substantially across countries. Unfortunately, empirical evidence from other countries is scarcer.

3. Consumer confidence indicators and their construction

3.1 The EC Consumer Confidence Indicator

The European Commission launched the first harmonised consumer survey in 1972. Five countries originally took part in the survey: Belgium, Germany, France, Italy, and the Netherlands. From the beginning the survey was conducted three times a year, but surveys with higher frequency were gradually introduced and by 1986 all participating member states conducted monthly surveys. Over the years, the number of countries included in the programme has expanded, and now it covers 29 countries.[6] At present, nearly 40 000 consumers are surveyed each month using a questionnaire that contains 15 questions, 12 monthly and 3 quarterly.

The four questions included in the Consumer Confidence Indicator (CCI) are:[7]

Q2 How do you expect the financial position of your household to change over the next 12 months?

Q4 How do you expect the general economic situation in this country to develop over the next 12 months?

Q7 How do you expect the number of people unemployed in this country to change over the next 12 months?

Q11 Over the next 12 months, how likely is it that you save any money?

Thus, all questions included in the CCI are forward looking and cover expectations of both the households own economic situation (Q2, Q11) and the general economy (Q4, Q7). An additional observation is thus that the questions stem from two different categories of questions, which can be termed micro-oriented questions (e.g. the financial situation of the household and the intention of the respondent to save money) and macro-oriented questions (e.g. the general economic situation in the country and unemployment). The Consumer Confidence Indicator is composed of two questions from

6 26 out of 27 Member States (Ireland is currently missing), and Croatia, the former Yugoslav Republic of Macedonia and Turkey.

7 This set of questions was introduced in January 2002, following a report from the IFO institute, commissioned by the Commission (Goldrian et. al, 2001). Before the confidence indicator was calculated from five questions (Q1, Q2, Q3, Q4 and Q11). The complete harmonised questionnaire is attached in Appendix.

each of these two categories. A complete list of the questions and their categorisation can be found in Table A1.

On the basis of the distribution of the various answering options for each question, aggregate so-called balances are calculated for each question. Balances are the difference between positive and negative answering options, measured as percentage points of total answers. More specifically, there are six answering options: very positive (a lot better, increase sharply, etc.); positive (a little better, increase, etc.), neutral (stay the same, etc.), negative (a little worse, decrease, etc.), very negative (a lot worse, fall sharply, etc.) and don't know. The balances are calculated on the basis of weighted averages according to the formula:

$$B = (PP + ½P) − (½M + MM), \quad (1)$$

where PP denotes the percentage of respondents with the most positive answer, P the positive, M the negative and MM the most negative. Hence, neither the neutral answering option (stay the same) nor the uncertain answer (don't know) is taken into account. By construction, the balances are bounded between -100, when all respondents choose the most negative option, and +100, when all respondents choose the most positive option.

The CCI is then calculated by averaging the balances from the four questions above. More specifically, the Consumer Confidence Indicator can be expressed as:

$$CCI = (BQ2+BQ4-BQ7+BQ11)/4. \quad (2)$$

Thus, all four questions receive an equal weight in the calculation of the CCI. In order to calculate the EU and euro-area aggregates, the national results are weighed according to the level of household consumption expenditures in the specific country. This implies that a consumer in a larger country receives a higher weight than a consumer in a small country, which is justified by their different national, rather than individual, consumption levels. Note that since the balances are not normalised, questions with higher volatility will dominate the movements of the CCI. For both the EU and the euro area, the macro questions have significantly higher volatility than the micro questions (for descriptive statistics of all the questions, see Table A1 in the appendix). The same pattern with higher volatility in responses to macro questions has also been noticed for US data (Dominitz and Manski, 2004).

3.2 The micro consumer confidence indicator – an alternative confidence indicator

The CCI tracks real consumption growth only to a limited extent. First, the correlation between the CCI and the reference series, private consumption growth, is relatively low, below 0.7. Second, and more important for forecasting and policy use, the indicator has in the recent past produced a very different signal than what is realised in the reference series. In this section we therefore put forward an alternative indicator based on micro questions.

Our hypothesis is that an indicator based on questions related to the household economy, rather than the general economy, would prove more informative than the CCI. There are at least two a priori rationales for including only micro-oriented questions rather than macro-oriented questions. First, it seems reasonable to assume that respondents to the surveys have better knowledge of their own economic situation than they have of the general economic situation in their country. This thought has been put forward and confirmed earlier in the literature (see e.g. Dominitz and Manski (2004) for US data). Given shortage of both time and ability, it simply makes more sense for the individual consumer to give priority to seeking information on their own economic situation rather than on the general economy. It is presumably also easier to gather information on and predict the household's own economic situation.

Second, if the aim is to predict developments in household consumption, micro questions seem preferable also on a conceptual basis. As long as survey samples are representative, the questions on household's financial situation, its intention to spend or to save (variables that may reflect the household's budget constraints) should aggregate into an indicator that resembles consumption. An indicator that includes questions on the general economic situation of the country should, on the other hand, aggregate into something that is different from consumption (possibly GDP). On this second argument, economic theory is not conclusive. On the one hand, micro questions seem to be more consistent with the Campbell& Mankiw model, where sentiment may predict spending via the income channel, since they more directly relate to the income of the household. On the other hand, according to Katona's more general view, sentiment reflects households' willingness to spend, which may well be reflected also in macro questions.

As an alternative to the CCI, we propose to use a different set of questions to produce a micro-consumer confidence indicator (MCCI). It includes four questions, all selected from the micro category. Using the same methodology as for calculating the CCI, the four questions included in the micro indicator are:

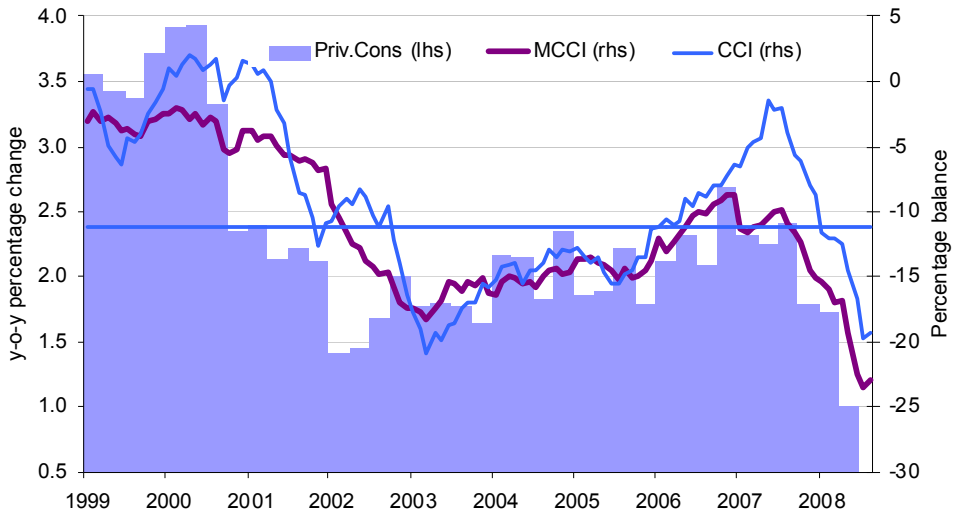
Q1 How has the financial situation of your household changed over the last 12 months?

Q2 How do you expect the financial position of your household to change over the next 12 months?

Q8 In view of the general economic situation, do you think that now it is the right moment for people to make major purchases such as furniture, electrical/electronic devices, etc.?

Q9 Compared to the past 12 months, do you expect to spend more or less money on major purchases (furniture, electrical/electronic devices, etc.) over the next 12 months?

Figure 1: Consumption growth and consumer confidence indicators for the euro area, standardised by the mean



Source: European Commission and own calculations

For the euro area, the MCCI seems to have done a better job in tracking y-o-y consumption growth in the past (see Figure 1). Fore example, looking at the developments of the indicators in the recent past, the message using the micro indicator is rather different from the one provided by the CCI. The MCCI has signalled a much more subdued growth path for private consumption, and the decline has also been deeper, underlining the severity of the current slowdown. More importantly, before turning down in mid 2007, the micro indicator just barely managed to sneak above its long-term average. The CCI, on the other hand, has been well above its long-term averages for almost two years, and thus signalled strong consumption growth, something which has not been realised. A more

in-depth comparative analysis of the MCCI and the CCI is done in the next section, where they are compared with all possible indicators that can be constructed with the answers to the EU harmonised consumer surveys.

4. Defining and finding the best indicator(s)

Building on the questions of the EU consumer survey, we aim at finding the indicator that has the highest coincident and leading correlation with private consumption growth. As mentioned previously, out of the 11 questions incorporated in the questionnaire, there exist 2 047 potential indicators. In this section, we calculate the coincident and leading correlations for all those indicators and rank them in descending order of correlation. Furthermore, the derived optimal indicator[8] is compared in more detail to the CCI, the above described micro indicator (MCCI), and a global optimal indicator, which is optimised across all countries. We also make a comparison with an indicator calculated based on factor analysis (see Gayer and Genet, 2006). Although our main interests are the EU and the euro-area aggregates, we also examine how the indicators perform at a country level. As a second step, we evaluate a selection of indicators by the additional predictive power they provide in a simple forecast model of consumption.[9]

The focus is on how to better capitalise on the current set of questions included in the harmonised consumer survey. Thus, the study is limited in the sense that we only consider the questions that are currently asked in the consumer surveys, and leave the issue of other methodological aspects of how to construct indicators aside to future research. We deem, however, that many other issues, such as normalisation and seasonal adjustment, are less important than the choice of questions.[10] Furthermore, since we are looking for a monthly indicator, we disregard the additional quarterly questions included in the harmonised EU questionnaire.

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8 Depending on the criteria imposed for determining optimality (e.g. coincident correlation, leading correlation, predictive power, or a combination), several different indicators can be judged as optimal.

9 Other potential aspects to evaluate are the ability of the consumer confidence indicator to detect turning points and its volatility. First, we argue that although detecting turning points is an important matter, it is difficult to do an empirical evaluation, as our reference series starts only in 1995. There are simply too few cyclical turning points. Second, concerning the volatility of the indicators, being a monthly indicator, we ideally would like it to provide reliable information each month. In practice, however, the survey indicators are somewhat noisy, which implies that the outcome for a single month should be interpreted tentatively, since it does not provide a certain signal for future changes. A popular measure of volatility is the so-called month of-cyclical dominance (MCD). The MCD measure indicates the fewest number of months needed for the movement in the trend component to exceed the irregular component. We calculated this measure for all indicators, but for the vast majority it does not provide any additional information that allows us to distinguish between indicators. In general, the MCD was low (1-2 months), which is very good as it implies that the indicators are smooth and that the signals provided are reliable just after a few months.

10 We have recalculated the CCI by first normalising the balances for their respective means and standard variations. It turned out that this normalised CCI was as correlated with actual private consumption growth as the non-normalised CCI.

Ideally one would strive for an indicator with as good leading properties as possible. It turns out, however, that rather than leading, most of our derived indicators are either coincident or lagging. One should keep in mind that the consumer confidence indicators are available on a monthly basis, with a significantly shorter publication lag than consumption data from the national accounts. The coincident CCI may therefore serve as a proxy for current unobserved consumption. Furthermore, in most cases, the indicators with high coincident correlations also have relatively high leading correlations, i.e. correlation with private consumptions one or more quarters ahead. The choice of indicator would therefore often be the same no matter if we look at coincident or leading properties. In the subsequent analysis, we search for two optimal indicators; one which has the single highest coincident correlation and another which has the highest correlation with a one-quarter lead.

As a reference variable we use household private expenditures, chain-linked volumes, from the quarterly national accounts provided by Eurostat. The series is transformed into year-on-year percentage changes. This transformation is not obvious, but choosing year-on-year changes instead of e.g. quarter-on-quarter changes can be justified for at least two reasons. First, all the harmonised questions in the consumer surveys refer to a 12-month horizon, and should in principle therefore also correspond better to developments over this period. Second, it is by far the most commonly used transformation when comparing survey data to reference series. The popularity of the year-on-year transformation may derive from that it is a smoother reference series than the quarterly one (since it can be expressed as a moving sum of quarterly differences).

As private consumption growth is only available at a quarterly frequency, either the reference series has to be made monthly or the survey data have to be transformed into a quarterly frequency. We choose the second alternative. The main reason for this choice is that forecasters are in general mainly interested in the quarterly outcomes of national accounts data. Transforming quarterly data into monthly also requires more, and less plausible, assumptions than transforming monthly series into quarterly. Therefore, before calculating any correlations, the monthly survey data is transformed into quarterly data by calculating the average balance of the three months in each quarter.[11]

4.1 The optimal indicator at EU and euro area level

Table 1 and Table 2 present the correlations and rankings for six different consumer confidence indicators in the EU and the euro area, respectively. The first two indicators in each table are the highest ranked indicators for coincident and leading correlation among the 2 047. The third is the globally optimal indicator, which is an indicator derived from an optimisation taking into account both the coincident and leading properties, and it should be the least harmful to use across all countries. This indicator is further described in the following section 4.2. The following two indicators are the CCI

Table 1: Indicators for the EU, sample 1995Q1 – 2008Q2, monthly survey data are averaged to quarterly

	Included questions[a]											Coincident	Ranking	Leading	Ranking
Indicator	1	2	3	4	5	6	7	8	9	10	11	Correlation	(1-2047)	Correlation	(1-2047)
Optimal coincid.		x			x		x	x	x			0.83	1	0.81	22
Optimal leading				x	x			x				0.81	115	0.83	1
Global			x					x	x			0.78	501	0.72	733
Micro	x	x						x	x			0.75	917	0.69	980
CCI		x		x			x				x	0.69	1519	0.64	1429
Factor-based[b]												0.75	893	0.69	1033

a) Note that question 5 and 7 are included with negative signs (since they are negatively correlated with the reference series). The questionnaire is attached in the appendix.

b) The factor-based indicator is described in Gayer and Genet (2006)

Source: European Commission and own calculations

and the micro indicator, which are described in the preceding section. We also include a factor based indicator, following the estimation procedures of Gayer and Genet (2006).

For the EU and the euro area, the optimal coincident and the optimal leading indicators generate very similar coincident and leading correlations. All these indicators include both macro and micro questions. In comparison to the optimal EU indicators, both the micro and factor based indicator have lower correlation than the optimal ones. At the euro-area level, on the other hand, the micro indicator

Table 2: Indicators for the euro area, sample 1995Q1 – 2007Q4, monthly survey data are averaged to quarterly

	Included questions[a]											Coincident	Ranking	Leading	Ranking
Indicator	1	2	3	4	5	6	7	8	9	10	11	Correlation	(1-2047)	Correlation	(1-2047)
Optimal coincid.		x		x	x			x	x			0.86	1	0.83	2
Optimal leading				x	x			x	x			0.86	3	0.83	1
Global			x					x	x			0.78	724	0.69	877
Micro	x	x						x	x			0.82	284	0.73	530
CCI		x		x			x				x	0.68	1617	0.61	1434
Factor-based												0.78	831	0.69	896

a) Note that question 5 and 7 are included with negative signs (since they are negatively correlated with the reference series). The questionnaire is attached in the appendix.

b) The factor-based indicator is described in Gayer and Genet (2006)

Source: European Commission and own calculations

[11] Taking the balance of the middle or the last month as the quarterly balance makes no difference for the results.

performs very close to the optimal indicator; it ranks among the 15 to 25 percent best indicators. The factor based indicator, however, is close to the median indicator in all cases.

For both the EU and the euro area, the CCI produces worse results than the micro and the factor-based indicators and of course the optimal ones. The correlation between the CCI and private consumption growth is relatively low, which is also reflected in the low ranking, which is close to or even below the 25th percentile. Interestingly, it appears that the CCI is based on different questions from those used by more performing indicators.

It is worth noting that most correlation coefficients lie within a narrow range. For instance, 50% of the indicators have a correlation between 0.76 and 0.86 for the euro area, while only 25% of the indicators have a correlation below 0.69. For the EU and the euro area the correlation range between the highest correlation and the median is only 0.08 and 0.10, respectively. Furthermore, the correlation thresholds for significance at the 5 percent level are 0.69 for the EU and 0.74 for the euro area; a correlation below these values implies that that an indicator has a significantly lower correlation than the maximum obtainable. Thus, the ranking figures provided below have to be interpreted bearing in mind that the correlation range down to a significantly poor indicator is relatively narrow. The CCI has correlations that are below the two thresholds and are significantly worse than the respective optimal indicators. A graphical illustration and descriptive statistics of the distributions of all indicators are available in Figure A1 and Table A3 in the annex.

4.2 The optimal indicators across countries

Carrying out the same optimisation procedure as above on a country level[12], we find that the optimal set of questions included in a consumer confidence indicator varies significantly across countries (Table 3). Despite the large differences in the optimal set of questions, a few common denominators may be worth noting. First, the most frequently included question across the optimal country indicators is the micro question whether consumers intend to make major purchases in the coming 12 months (Q9), which is closely followed by the question about how consumer prices have developed during the past 12 months (Q5). Thus, in many countries lower perceived inflation is associated with higher consumption expenditures. The third most frequently included question is the other micro question concerning the present willingness of making major purchases (Q8). In general, however, we do not find that micro questions are more often included in the optimal country indicators

[12] The optimisation is based on consumption and survey data from 25 EU member states. Bulgaria and Romania are excluded from the sample as quarterly consumption data is not available.

than the macro questions. It therefore seems that at the country level the micro questions are not superior with regard to their coincident correlations.[13]

The highest achieved coincident correlation also varies significantly across countries, ranging from above 0.85 in EE, LV, LT, HU, PL and PT, to below 0.50 in BE, CY, MT, NL, AT and SI. Given the large variation across countries in the optimal set of questions to be included, it seems inappropriate to use our derived optimal indicator for the EU at a country level. If we, nevertheless, want to avoid using 27 different indicators (25 countries plus the EU and the euro area), we may ask which common indicator is the most appropriate one, i.e. the least harmful to use across all countries and aggregate economic areas. The answer to this question is found by calculating a statistic that minimises the difference from the optimal indicators across countries and areas. More specifically, we seek the globally best indicator that minimises the average sum of squared differences between both coincident and leading correlations and the respective optimal indicators:[14]

$$\min \sqrt{\sum_{c=1}^{27} \left(\rho_c^{Optimal,coincident} - \rho_c^{Coincident}\right)^2 + \left(\rho_c^{Optimal,leading} - \rho_c^{Leading}\right)^2 / 54} \,. \tag{3}$$

The best global indicator turns out to include questions: Q3 past general economic situation (macro), Q8 currently the right time to make major purchases (micro), and Q9 plans for making major purchases within in the next 12 months (micro). Table 3 also shows how this globally optimal indicator performs at the country level. In general, the differences in correlations between the countries' optimal indicator and the globally optimal indicator are rather small; although in some cases the correlations are significantly lower (for example Belgium, Cyprus, Malta, and Finland). This means that the globally optimal indicator is not only the best across countries, but also that it delivers satisfactory correlations compared to the indicators optimised for each country. An additional attractive feature of the global indicator is that it also performs very well at the EU and the euro-area levels (for a graphical alternative to Table 3, see Figure A2 in the appendix).

Comparing the performance of the CCI to the optimal ones, there are in most countries large correlation gains to be made. For instance, in Germany the correlation increases from 0.2 to 0.7 or 0.6, depending on which optimal indicator is used. The CCI only belongs to the 25 percent best indicators in three countries (Spain, France, and Slovakia), while it is among the 25 percent worst indicators in ten countries. We conclude that also at the country level, the CCI in general does not efficiently use the information available to track private consumption.

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13 This conclusion is also true for leading correlations.

Table 3: Optimal coincident country indicators, compared to global optimal, CCI, and micro indicators

	Optimal set of questions[a]											Coincident correlation by indicator			
Country	1	2	3	4	5	6	7	8	9	10	11	Country Optimal	Global Optimal[b]	Micro	CCI
BE				x			x			x		0.29	0.02	-0.06	0.20
CZ	x				x	x		x		x		0.79	0.65	0.71	0.50
DK	x		x	x					x			0.69	0.57	0.57	0.52
DE					x	x			x		x	0.66	0.38	0.49	0.21
EE				x	x	x	x		x			0.88	0.72	0.73	0.75
IE					x						x	0.73	0.63	0.54	0.54
GR				x					x			0.57	0.47	0.39	0.11
ES							x					0.80	0.69	0.64	0.64
FR							x	x				0.72	0.69	0.61	0.58
IT		x	x	x				x	x	x		0.71	0.65	0.59	0.48
CY								x				0.38	-0.03	-0.32	-0.58
LV				x				x	x			0.87	0.85	0.81	0.72
LT					x	x	x	x	x	x		0.95	0.90	0.85	0.83
LU	x	x	x		x				x		x	0.79	0.55	0.63	0.58
HU		x	x			x						0.91	0.75	0.76	0.80
MT					x	x		x	x			0.41	0.00	-0.06	-0.23
NL			x									0.49	0.47	0.32	0.40
AT	x	x		x						x		0.43	0.36	0.24	0.14
PL					x	x	x		x		x	0.86	0.71	0.77	0.75
PT			x	x								0.85	0.76	0.72	0.78
SI					x			x	x			0.26	0.15	0.08	-0.19
SK		x			x				x			0.75	0.66	0.65	0.71
FI								x				0.62	0.27	0.15	-0.14
SE		x		x	x				x	x		0.75	0.56	0.37	0.59
UK	x		x			x		x				0.74	0.69	0.41	0.37
Sum	5	6	7	9	11	8	6	10	13	6	4				

a) Note that question 5 and 7 are included with negative signs (since they are negatively correlated with the reference series). The questionnaire is attached in the appendix.

b) The global optimal indicator is found through an optimisation that takes into account both the coincident and the leading properties at the same time, see equation (3).

Source: European Commission and own calculations

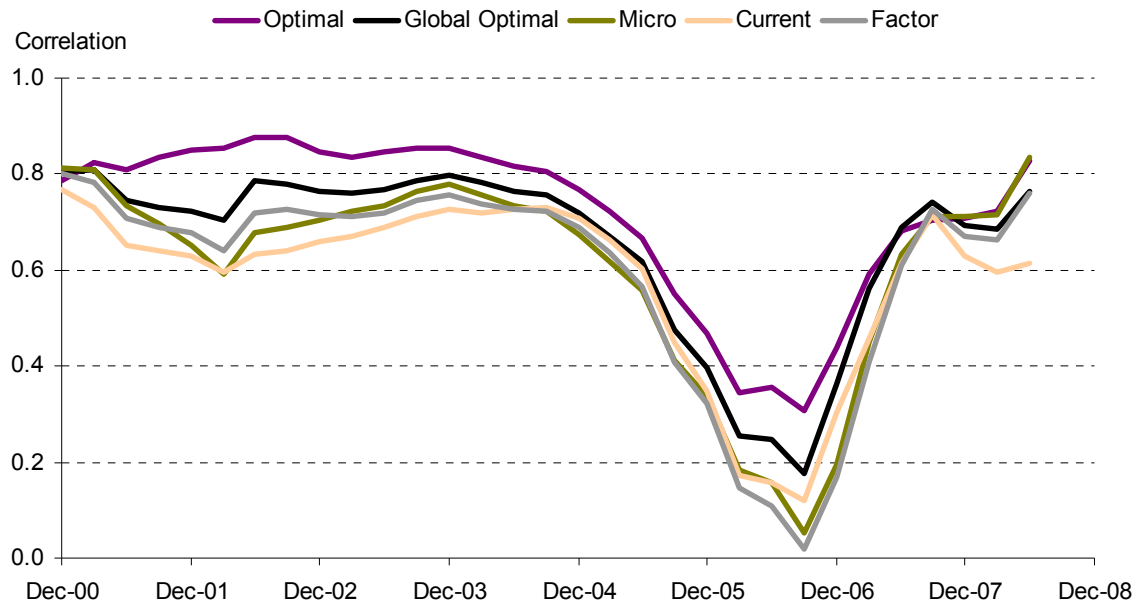
[14] It would also be possible to optimise by weighting the individual countries by size. We choose to treat all countries as equally important and thus use an equal weighting. Furthermore, weighting each country by size, basically amounts to calculating the EU or the euro area indicators; the optimal indicators for these areas can be found in Table 1 and Table 2.

The micro indicator, on the other hand, performs better than the CCI in a majority of countries. Furthermore, it receives an overall global ranking of 248 (out of 2 047), where both the leading and lagging properties have been taking into account. Only in very few cases the CCI performs significantly better than the micro indicator (Belgium, Netherlands, and Sweden). The micro indicator can be said to be a reliable and good performer, as it has proved to consistently provide high correlations across countries with different and not perfectly synchronised business cycles. This persistently good ranking can be seen as a stability check of the indicator. [15]

4.3 Stability tests

By crosschecking correlations across countries, only the CCI and the micro indicators have been assessed for the stability of their ranking. To further investigate the stability of the other indicators presented in Table 1 and Table 2, we calculate moving correlations over a period of five years, i.e. the correlations are based on 20 quarters of data. For the EU and euro area respectively, Figure 1 and Figure 2 presents the moving correlations for each indicator (excluding the optimal leading indicator[16]).

Figure 2: Moving correlation for the EU

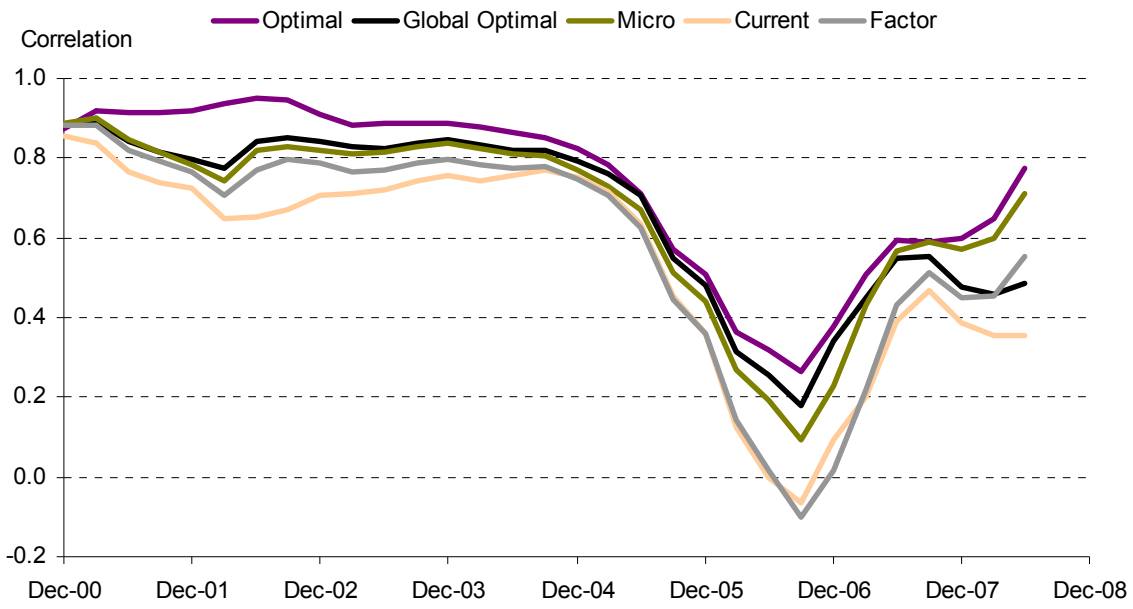


Source: European Commission and own calculations

15 As national business cycles are not completely synchronised in the EU (see Gayer, 2007), checking the ranking and correlation of the CCI and the micro indicators across countries can be seen as a test of stability across different business cycle phases.

In the EU, all the considered indicators have been stable with a correlation above 0.6, except for a brief period of 7 quarters (third quarter of 2005 to first quarter of 2007). The picture is similar for the euro area, but the decline in correlations was greater and the recovery weaker than for the EU as a whole. This dip in correlations is explained by the differences in behaviour of the two entities consumer sentiment and real private consumption. While sentiment was clearly improving over time, consumption growth was oscillating around 2 percent, with only a weak upward trend. The relatively smooth upward trend in consumer confidence was matched by relatively variable private consumption growth, giving rise to low correlations.

Figure 3: Moving correlation for the euro area



Source: European Commission and own calculations

More importantly, the correlation rankings of the previous sections remain intact over time. The optimal indicators for the two areas are basically the optimal ones for the entire period studied. The global optimal indicator is the second best indicator, closely followed by the micro indicator, especially for the euro area. Yet again the, CCI and the factor based indicators are the least performing among the ones presented. Interestingly, after having been performing poorly in the dip of 2005-2006, the micro indicator is performing very well towards the end of the sample, when correlations are close to the maximum possible to achieve.

Figure A3 and Figure A4 in the appendix present the corresponding moving rankings of the

16 The optimal leading indicator overlaps almost completely with the coincident one.

indicators. As expected, the moving rankings provide a similar result to those of the moving correlations. There is, however, a large degree of volatility in the rankings for some indicators. Furthermore, there is a sharp drop in the ranking of the optimal EU indicator in September 2007, the ranking falls from a top notch position down to close to 1 500. The reason for these large shifts in rankings is that the total range of correlations is very narrow for these time periods. For example, in September 2007 87% of all correlations fall within the range of 0.76 to 0.69; small changes in the third and fourth digit can change the ranking significantly. In these particular periods, the correlations are so close that the ranking and relative shifts are irrelevant.

To sum up, the different indicators' correlations show that in general the EU and the euro-area optimal indicators remain the best performers over time. They are, however, not necessarily optimal for all countries in the EU. The global optimal indicator, which fits most countries relatively well, is a good second best choice, closely followed by the micro indicator, especially for the euro area. The least performing indicators in this group of six are the CCI and the factor based consumer confidence indicators.

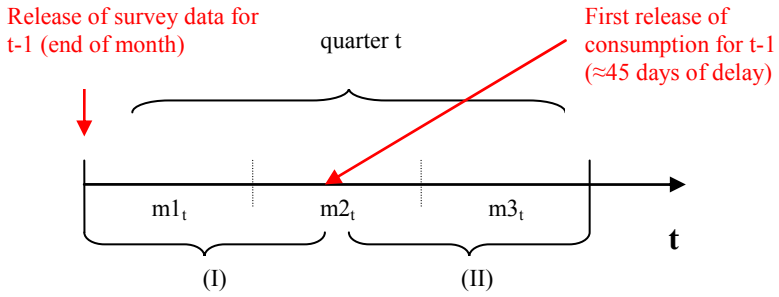
5. The predictive power of consumer confidence

It is fair to argue, that considering only correlations may not be sufficient to identify an ideal indicator. In order to evaluate the true, incremental, predictive value of consumer sentiment, one would need to condition on other determinants of private consumption. Usually, the methodological way forward is to regress private consumption growth on some predefined determinants, such as lagged values of private consumption growth, disposable income, interest rate etc., and compare the share of variance (measured as R2) that is explained by this benchmark model to another model, which also incorporates consumer sentiment. In doing so one receives an estimate of the marginal contribution of consumer sentiment. In this section we follow this approach in order to assess the incremental predictive value of the indicators derived in the previous section.

The choice of determinants or control variables in the benchmark model is of course crucial. Following previous studies (Carroll et al., 1994 and Easaw et al., 2005), we estimate a model including the following control variables for the euro area: four lags of the dependent variable (i.e. y-o-y private consumption growth) and four lags of the y-o-y disposable income growth.[17] The results suggest, however, that income cannot significantly explain short-term variation in private consumption growth. Furthermore, only one lag of the dependent variable turned out to be significant. Thus, the AR(1) model became our benchmark model.

[17] We also tried other control variables (compensation per employee, short and long-term interest rate, unemployment), but without useful results. Note also that household disposable income for the euro-area is not available before 1999, which led us to use compensation per employee as a proxy for this period.

Figure 4: Typical forecast situations - releases of survey data and quarterly national accounts



One of the most important features of survey data, which should be considered in assessing their predictive power, is their short publication delay. Suppose that we would like to forecast the outcome for the current quarter t. Depending on when during this quarter we would like to carry out the forecast, different information will be available. Figure 1 sketches the typical situation for quarter t and its three months (labelled m1t, m2t and m3t). While survey data arrives at the end of each month, consumption figures for the preceding quarter will arrive in the mid of the quarter. This implies that if we would like to carry out the forecast during the first half of quarter t, indicated as (I) in the graph, the outcome of private consumption for quarter t-1 will not be available.

Having this release schedule in mind, a reasonable forecast model in this particular situation may then be specified as:

$$\hat{c}_t = \alpha + \beta_0 c_{t-2} + \beta_1 CI_{t-1} + \varepsilon_t \qquad (4)$$

where c is year-on-year change in private consumption, CI refers to the confidence indicator and ε is the error term.[18] Hence, the survey data in this case have the advantage of being one quarter ahead of lagged private consumption. If we instead would like to carry out the forecast during the second half of the quarter, we may make use of the outcome from the last quarter. The forecast model may in this case be specified as:

$$\hat{c}_t = \alpha + \beta_0 c_{t-1} + \beta_1 CI_{t,m1} + \varepsilon_t \qquad (5)$$

[18] Note that this procedure amounts to a test of Hall's (1978) random walk hypothesis; if either of the coefficients to the explanatory variables turns out not to be zero, the hypothesis is rejected.

where $CI_{t,m1}$ refers to the indicator for the first month in the quarter. In this case survey data for the first (or even the second month) of the current quarter will be available. Consequently, when assessing the predictive value of consumer sentiment one should also take into account their timeliness as compared to many other variables (e.g. from the quarterly national accounts), which is often a neglected issue.

The models above are estimated for the different consumer confidence indicators discussed in the previous section. In order to limit the scope, only the EU, the euro area and the five largest Member States are considered. The results for the second model, expressed in equation (5), are shown in Table 4.[19]

Table 4: Share of variance explained by different indicators (adjusted R2-values)

	EU	EA	DE	FR	IT	ES	UK
Benchmark model ($\beta_1 = 0$)	0.64	0.68	0.43	0.52	0.56*	0.74	0.54*
Models including indicator							
Optimal (coincident)[1]	0.74	0.77*	0.56*	0.56	0.55	0.82*	0.54
Optimal (leading)[1]	0.76*	0.77*	0.52	0.55	0.55	0.81	0.54
Global	0.70	0.71	0.47	0.56	0.55	0.76	0.54
Micro	0.69	0.72	0.52	0.56	0.55	0.76	0.53
CCI	0.67	0.69	0.44	0.57*	0.56	0.77	0.53
Factor-based	0.69	0.71	0.47	0.57*	0.55	0.77	0.54

*) Indicator with highest correlation for each economic area or country

1) Each indicator is optimised for its economic area or country, respectively.

Note: sample sizes differ across areas and countries (longest available is used)

Source: European Commission and own calculations

For both the EU and the euro area, the optimal indicators, derived from correlation analysis only, stands out in terms of predictive power. In both areas, the optimal leading indicator seems superior and also significantly better than the benchmark model. At the country level, the picture is more mixed. The optimal indicators derived for Germany and Spain also perform well. For Germany, however, the values are low in general, reflecting a difficulty to explain short-term developments in German households' consumption. In France, it seems that the CCI or factor-based indicators are the best ones, although the share of variance explained by each indicator is low. For both Italy and the UK, confidence indicators seem not to be useful in explaining the variation in household consumption.

To further examine the use of the indicators in forecasting, the estimated models are also evaluated

19 Results for the first model are very similar.

against their out-of-sample performance, i.e. in terms of the forecasting errors.[20] The starting sample for the estimations is the first quarter of 1996 until the third quarter of 2003, where forecasts for the following quarter (fourth quarter 2003) are saved. The models are then re-estimated by stepwise increasing the sample with one quarter, and for each re-estimation the forecasts are saved. The procedure is repeated until the last observation, which is the second quarter of 2008. Thus, we receive in total 20 forecasts, which are compared to the realised values by calculating the root mean squared errors (RMSEs). The results are displayed in Table 5.

Table 5: Out-of-sample root-mean-squared-errors (RMSEs)

	EU	EA	DE	FR	IT	ES	UK
Benchmark model ($\beta_1 = 0$)	0.36	0.44	1.01	0.40	0.76	0.57	0.66
Models including indicator							
Optimal (coincident)[1]	0.26*	0.33*	0.75*	0.37	0.84	0.41*	0.64
Optimal (leading)[1]	0.26*	0.33*	0.96	0.31	0.85	0.44	0.64
Global	0.28*	0.40	1.06	0.33	0.81	0.54	0.62
Micro	0.26*	0.35*	0.95	0.33	0.79	0.51	0.66
CCI	0.33	0.43	1.03	0.38	0.92	0.52	0.65
Factor-based	0.29*	0.39*	1.02	0.31	0.83	0.53	0.63

) Indicates statistically significantly lower RMSEs compared to the benchmark model. To examine the statistical significance of the forecast errors, realised from the different models, we apply the asymptotic test proposed by Diebold and Mariano (1995). The null hypothesis states that there is no difference between the loss functions (here defined as the mean squared errors) between the two models, while the alternative hypothesis states that the AR(1) model produces higher mean squared errors. In Table 5, a "" indicates a rejection of the null at the 5%-significance level. (The Newey-West corrected standard errors that allow for heteroskedastic auto-correlated errors were applied.)

1) Each indicator is optimised for its economic area or country, respectively.

Note: Sample size 1996Q1-2008Q2 (including 20 out-of-sample forecasts)

Source: European Commission and own calculations

The out-of-sample exercise shows that the optimal indicators stand out in terms of their predictive power. For both the EU and the euro-area, the optimal indicators significantly increase the forecast precision compared to the benchmark model. Furthermore, the micro indicator and, to a lesser extent also, the factor based indicator has predictive power.

Perhaps somewhat surprisingly, almost all indicators fail to significantly improve forecasts for the five large countries examined. The only exceptions are the optimal (coincident) indicators in Germany and Spain, respectively, which both seem to be useful in forecasting spending.

20 Since we do not make use of vintage data, and national accounts data are often revised, note that the out-of-sample evaluation is not a test of real-time performance. In contrast to an in-sample evaluation the out-of-sample evaluation takes into account the uncertainty surrounding the parameter estimates.

6. Concluding remarks

Using 11 questions included in the EU harmonised consumer questionnaire, it is possible to construct 2 047 different confidence indicators. We search through all these indicators in order to find the indicator that has the highest correlation with private consumption growth. Moreover, we contrast this indicator to the consumer confidence indicator used by the European Commission, and some alternative indicators; also in terms of their predictive power of private consumption. In this context, we test the hypothesis that an indicator based on questions related to the household, rather than the general economy, would prove more informative.

The optimal indicator in both the EU and the euro area turns out to include both micro and macro questions. Thus, in a strict sense, our hypothesis of the superiority of the micro questions cannot be confirmed. In a broader perspective, however, we find that a set of micro questions seems to be more informative of private consumption growth than most combinations where macro questions are included. Reflecting this, the micro indicator performs better in tracking private consumption growth than both the factor based indicator and the CCI, in particular for the euro-area aggregate.

Although the CCI turned out to perform relatively worse than the other indicators, some further investigations needs to be done before modifying it. Our optimal indicator is obviously derived from the historical relationship between the indicator and private consumption growth. As new information will become available the composition of questions in the optimal indicator will almost certainly change. As the optimisation procedure applied is fairly straightforward one may of course up-date the optimal indicator each month when new data arrives. This principle would somehow be analogous to indicators based on extracted factors using the most recent data available. However, a change of indicator may be based not only on historical performance, but also on more principal, and economic, grounds, which speaks in support of the micro indicator.

Our results also underline the large variation across countries. The optimal set of questions included varies considerably and the best indicator derived for the EU and euro area does not in general perform well at the country level. As a consequence, we derive a globally best indicator that ideally should be used for comparisons across countries. This indicator delivers satisfactory correlations compared to the indicators optimised for each country, and it is also well-correlated at the EU and the euro-area levels. In addition, the micro indicator also stands out well across countries, and furthermore, in almost all countries, it is better correlated with household spending than the CCI.

It should be pointed out that consumer sentiment may be considered as measuring something multidimensional and the consumer survey's raison d'être may therefore not only lay in its use as an early indicator of private consumption growth, but has a wider usage (e.g. simply as a measurement of overall consumer confidence). In our view, however, the use of such an indicator is rather unclear, and

we deem that the ability of a consumer confidence indicator to predict developments in private consumption is of superior importance. Also, most previous research has been focussed on consumer confidence indicators ability to predict private consumption growth.[21] Another related aspect, which is left for future research, is to take into account the role of the consumer confidence indicator in the overall Economic Sentiment Indicator (ESI).[22] The optimal indicators we have derived are not necessarily the optimal ones to be included in the ESI.

This raises yet another issue: should use be made of several different "optimal" consumer confidence indicators, which are not necessarily comparable, or is it better to make the trade-offs and select the least "damaging" indicator. Releasing several different consumer confidence indicators certainly comes at a cost in terms of communication and an increased risk of confusion, but making use of only one indicator could restrain the analysis, especially for individual countries, and reduce the predictive power that could be extracted from the EU consumer surveys.

Finally, we would like to stress the importance and usefulness of consumer surveys in general and the EU harmonised survey in particular. Although our analysis seems to show that the confidence indicators are mainly coincident, they still have a significant publication lead and, occasionally, predictive power of private consumption growth. At the EU and euro-area level correlations are in general higher than at country level. The sometimes low correlation at the country level is not a sign of bad survey data, but to a large extent due to erratic quarterly consumption series. Overall, the confidence indicators are an essential complementary tool for analysing underlying economic developments, and in some cases they are the only source of information, e.g. for those countries without publically available quarterly national accounts, but also for those countries that lack data on, for example, disposable income. The Commission's survey programme is hence unique and very valuable when conducting economic surveillance.

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21 There are exceptions. For instance, Matsuka and Sorbone (1995) choose to look into the relationship between consumer sentiment and general economic fluctuations. Taylor and McNabb (2007) find that consumer survey indicators generally play a significant role in predicting downturns.

22 The Economic Sentiment Indicator is a composite indicator calculated by the European Commission. It is based on a selection of 15 questions from all sectors covered by the EU Harmonised Programme of Business and Consumer Surveys.

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Appendix

Consumer survey – Questionnaire (monthly questions)

Q1 How has the financial situation of your household changed over the last 12 months? It has...

+ +	got a lot better
+	got a little better
=	stayed the same
−	got a little worse
− −	got a lot worse
N	don't know.

Q2 How do you expect the financial position of your household to change over the next 12 months? It will...

+ +	get a lot better
+	get a little better
=	stay the same
−	get a little worse
− −	get a lot worse
N	don't know.

Q3 How do you think the general economic situation in the country has changed over the past 12 months? It has...

+ +	got a lot better
+	got a little better
=	stayed the same
−	got a little worse
− −	got a lot worse
N	don't know.

Q4 How do you expect the general economic situation in this country to develop over the next 12 months? It will...

+ +	get a lot better
+	get a little better
=	stay the same
−	get a little worse
− −	get a lot worse
N	don't know.

Q5 How do you think that consumer prices have developed over the last 12 months? They have…

+ +	risen a lot
+	risen moderately
=	risen slightly
−	stayed about the same
− −	fallen
N	don't know.

Q6 By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months? They will…

+ +	increase more rapidly
+	increase at the same rate
=	increase at a slower rate
−	stay about the same
− −	fall
N	don't know.

Q7 How do you expect the number of people unemployed in this country to change over the next 12 months? The number will...

+ +	increase sharply
+	increase slightly
=	remain the same
−	fall slightly
− −	fall sharply
N	don't know.

Q8 In view of the general economic situation, do you think that now it is the right moment for people to make major purchases such as furniture, electrical/electronic devices, etc.?

+ +	yes, it is the right moment now
=	it is neither the right moment nor the wrong moment
− −	no, it is not the right moment now
N	don't know.

Q9 Compared to the past 12 months, do you expect to spend more or less money on major purchases (furniture, electrical/electronic devices, etc.) over the next 12 months? I will spend…

+ +	much more
+	a little more
=	about the same
−	a little less
− −	much less
N	don't know.

Q10 In view of the general economic situation, do you think that now is...?

+ +	a very good moment to save
+	a fairly good moment to save
−	not a good moment to save
− −	a very bad moment to save
N	don't know.

Q11 Over the next 12 months, how likely is it that you save any money?

+ +	very likely
+	fairly likely
−	not likely
− −	not at all likely
N	don't know.

Q12 Which of these statements best describes the current financial situation of your household?

+ +	we are saving a lot
+	we are saving a little
=	we are just managing to make ends meet on our income
−	we are having to draw on our savings
− −	we are running into debt
N	don't know.

Table A1: Volatility and averages of balances per question

Question	Type	Standard deviation	Mean
9	micro	2.3	-16.0
2	micro	3.4	-1.8
11	micro	4.3	-6.6
12	micro	4.6	1.8
1	micro	5.0	-9.8
10	macro	6.6	35.9
4	macro	8.3	-10.9
8	macro	9.4	-13.0
6	macro	9.9	22.7
7	macro	13.4	-25.1
3	macro	14.4	-24.7
5	macro	14.6	26.8

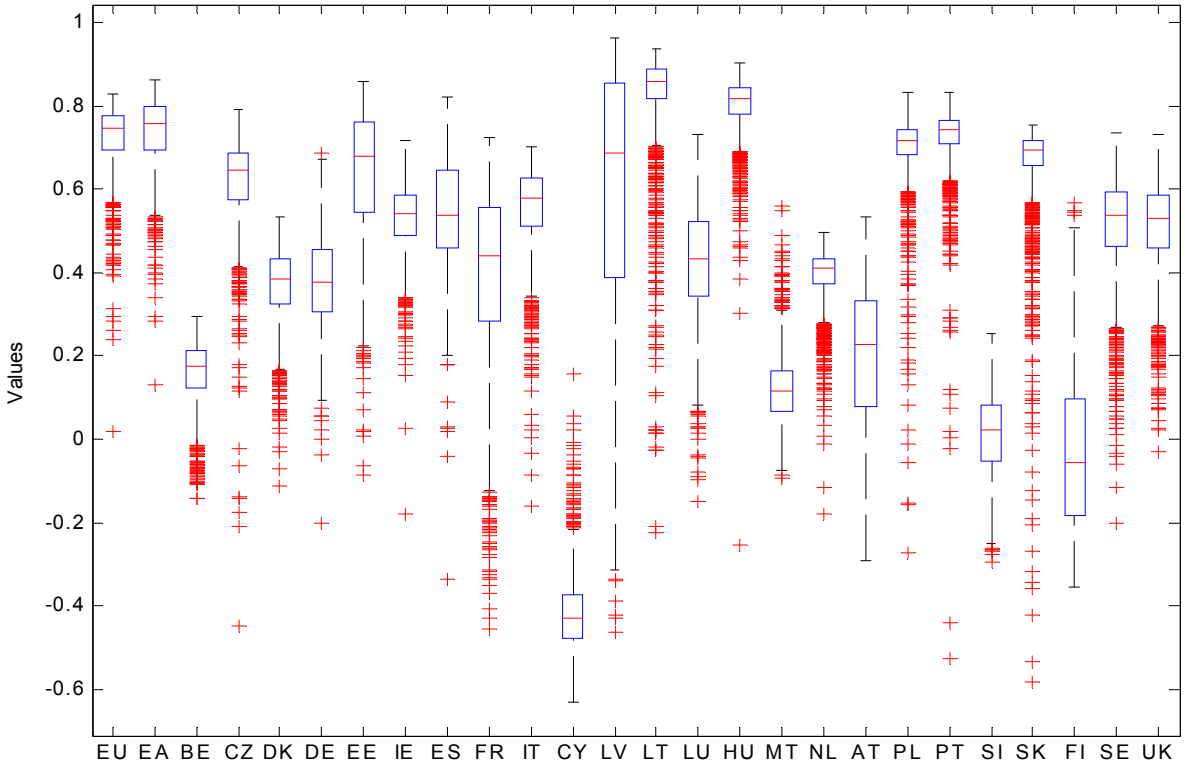
Source: European Commission and own calculations

Table A2: Descriptive statistics of the correlations of the 2 047 indicators

Country	Min	25th percentile	Median	75th Percentile	Max	Mean	Skewness
EU	0.02	0.69	0.75	0.78	0.83	0.73	-2.06
EA	0.13	0.69	0.76	0.80	0.86	0.74	-1.40
BE	-0.14	0.12	0.18	0.21	0.29	0.16	-1.03
CZ	-0.45	0.58	0.65	0.69	0.79	0.62	-2.57
DK	-0.11	0.33	0.39	0.43	0.53	0.37	-1.06
DE	-0.20	0.31	0.38	0.45	0.69	0.38	-0.08
EE	-0.09	0.54	0.68	0.76	0.86	0.64	-0.95
IE	-0.18	0.49	0.54	0.59	0.72	0.53	-1.22
ES	-0.34	0.46	0.54	0.64	0.82	0.54	-0.44
FR	-0.45	0.28	0.44	0.56	0.72	0.40	-0.93
IT	-0.16	0.51	0.58	0.63	0.70	0.56	-1.72
CY	-0.63	-0.48	-0.43	-0.37	0.16	-0.42	1.10
LV	-0.46	0.39	0.69	0.85	0.96	0.59	-0.89
LT	-0.22	0.82	0.86	0.89	0.94	0.83	-3.90
LU	-0.15	0.34	0.43	0.52	0.73	0.43	-0.39
HU	-0.25	0.78	0.82	0.84	0.90	0.80	-3.84
MT	-0.09	0.07	0.12	0.17	0.56	0.12	0.84
NL	-0.18	0.37	0.41	0.43	0.50	0.39	-2.17
AT	-0.29	0.08	0.23	0.33	0.53	0.20	-0.51
PL	-0.27	0.68	0.72	0.74	0.83	0.70	-4.93
PT	-0.53	0.71	0.74	0.77	0.83	0.73	-6.04
SI	-0.29	-0.05	0.02	0.08	0.25	0.01	-0.40
SK	-0.58	0.66	0.70	0.72	0.76	0.66	-4.98
FI	-0.35	-0.18	-0.06	0.10	0.57	-0.03	0.55
SE	-0.20	0.46	0.54	0.59	0.74	0.51	-1.48
UK	-0.03	0.46	0.53	0.58	0.73	0.51	-1.16

Source: European Commission and own calculations

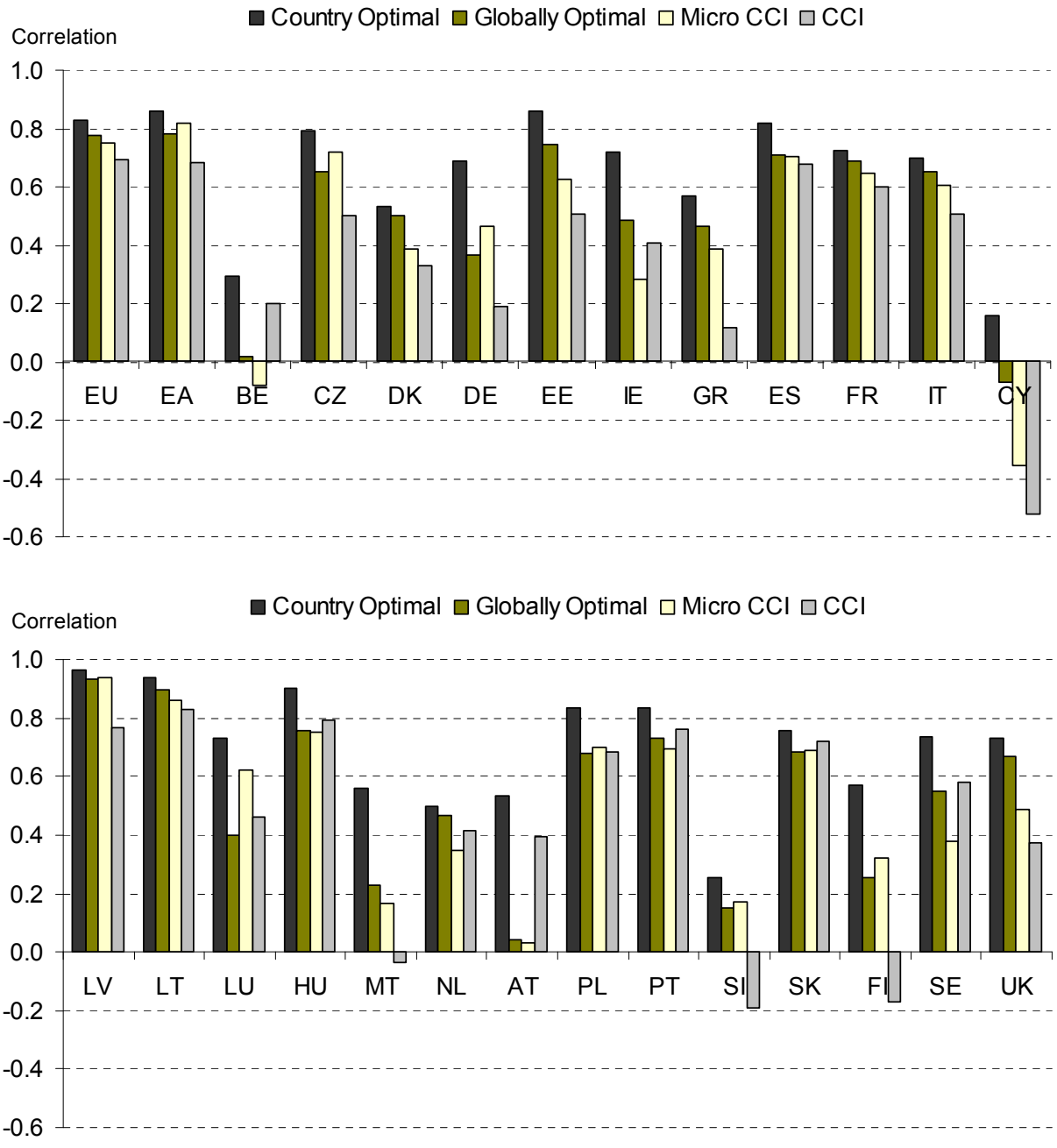
Figure A1: Box plots[1] of EU, euro area, and country distributions of 2 047 correlations



Source: European Commission and own calculations

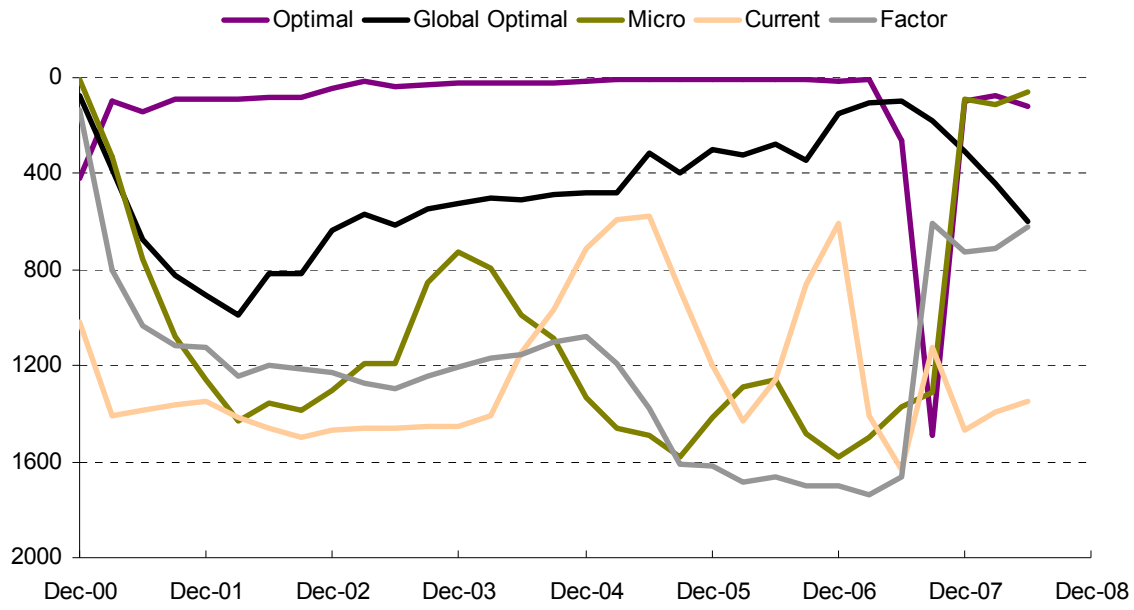
1) The box plot summarises the information from all 2 047 correlations for each country. The box has lines at the lower quartile, median, and upper quartile values. The whiskers are lines extending from each end of the box to show the extent of the rest of the data. Outliers are data with values beyond the ends of the whiskers. If there is no data outside the whisker, a line is placed at the bottom whisker.

Figure A2: Optimal coincident country indicators, compared to global optimal, CCI, and micro indicators (graphical illustration of Table 3)



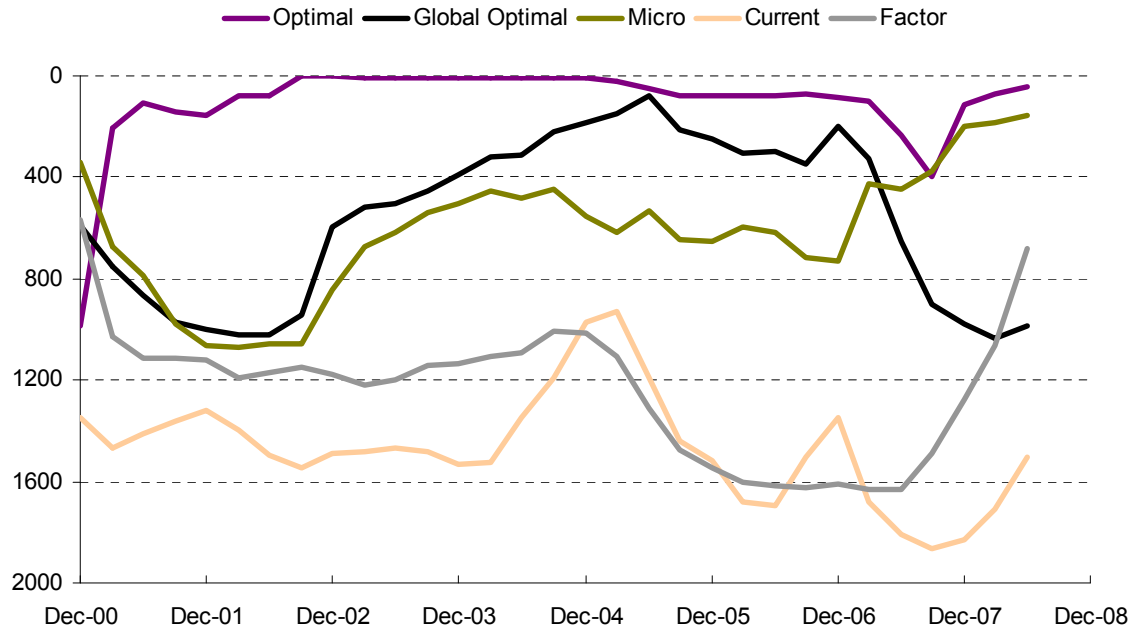
Source: European Commission and own calculations

Figure A3: Moving rank of correlations for the EU



Source: European Commission and own calculations

Figure A4: Moving rank of correlations for the euro area



Source: European Commission and own calculations